

PREFACE

Heterocyclic compounds constitute the largest classical division of organic chemistry and are of immense importance in biological, pharmaceutical and industrial fields. They are ubiquitous in nature and conquer almost every part of a developed human society from vitamins, antibiotics, alkaloids, carbohydrates and other natural products to pesticides, dyestuffs, textiles, lubricants, paints, food and nutrition. Their synthesis and functionalization have remained a vast area of research from many decades.

Over the last two decades, organic synthesis has taken a major turn towards developing reaction conditions that are environment-friendly, sustainable and amenable to industries. Recent developments have replaced with the traditional synthetic routes by the greener, safer and economically more viable methodologies. In this context, solid-surface promoted reactions, heterogeneous catalysis, use of focused microwaves, metal-free, solvent-free and room temperature reactions are some of the major points of interest to the synthetic chemists. While different porous inorganic oxides often facilitate various organic reactions and are considered favourable to promote eco-friendly chemical processes, organic polymers are also utilized as supports for mediating organic reactions and for the immobilization of metal nanoparticles for further use. In the recent years, metal organic frameworks (MOFs) and carbonaceous materials like graphene (G), graphene oxide (GO) and reduced graphene oxide (rGO) are proven to be extremely useful for diverse purposes. The present works primarily include organic reactions catalyzed by GO as well as selective reaction mediated over inexpensive and commercially available silica. Both materials are easily recoverable and reusable for several runs without any significant drop in their catalytic activity or yield of the product(s) and change in their morphology and functionality. Some of their utilizations have been demonstrated in the present dissertation, which consists of six chapters including the first chapter delineating a brief introduction on the background literature review. During this investigation, new observation like the use of *N,N*-dimethylformamide (DMF) as a source of *N,N*-dimethyl group ($-NMe_2$) has been established as a practical method for making aryl thioamides.

Catalytic activity of GO has been explored in **Chapter II** towards the green synthesis of pharmacophore imidazo[1,2-*a*]pyridines and further one-pot sulfenylation to 3-sulfenylimidazo[1,2-*a*]pyridines in three-component reaction. The GO-catalyzed multi-component tandem reactions and application to important pharmaceutically active scaffolds

are hitherto unknown and reported for the first time. Further applications of this sustainable and easily available carbonaceous material are expected to come out in the synthesis of diverse complex molecules of importance in pharmaceutical chemistry and material sciences. Another application of GO as 'carbocatalyst' in one-pot sequential dehydration-hydrothiolation of *sec.* aryl alcohols to the selective formation of Markovnikov adduct has been described in **Chapter III**. Graphene-based materials (GO) as 'carbocatalyst' is a recent field of interest. Metal-free catalysis under mild conditions is indeed promising and expected to reveal a host of new catalytic applications. Utilization of silica as an efficient catalyst for one-pot solvent-free regioselective tandem synthesis of 1,2- or 1,3-dithioethers constitutes the **Chapter IV**. Diverse reactivity of silica in the formation of vicinal or 1,3-dithioethers is likely to spur not only adopting the procedures for selective dithioether preparation but also to attract more new applications. Further application of this diverse reactivity is underway in this laboratory. A new process of amidation of 'transient' thiobenzaldehyde, resulting from disulfides in the presence of base, by using *N,N*-dimethylformamide (DMF) as both solvent and reagent has been established in **Chapter V**. Aryl thioamides are important class of compounds and their classical synthesis includes Willgerodt-Kindler (WK) reaction. The present study involving inexpensive DMF could not only replace the common WK reaction that requires harsh conditions but also spur diverse reactions with the aid of DMF beyond its uses as a solvent. Finally, the **Chapter VI** deals with some pharmaceutically important scaffolds and their further functionalization via C–C cross-coupling reaction. Although the last chapter is partly of exploratory nature, the results are indicative of further scope and would be developed in future studies.